

Logistics Management Institute

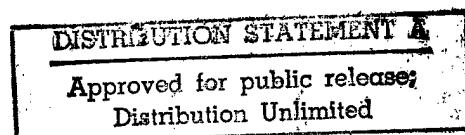
**Material Distribution Logistics
in the Public Sector
An Executive's Guide**

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August 1997

Samuel J. Mallette

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Contents

INTRODUCTION.....	1
PART I—WHEN TO STOCK	3
PART II—THE COST OF INTERNAL DISTRIBUTION.....	6
PART III: THE USE OF AUTOMATION	10
PART IV—COMMON IMPROVEMENTS	14
Outsource	14
Broaden the Scope of the Logistics Team.....	14
Focus Consumers on Total Cost	15
Add Customer Performance Reporting.....	15
Communicate Frequently with Customers.....	16
Try Operating Logistics as an Independent Business.....	16
Streamline the Excess Property Handling Procedures	16
Follow Basic Warehousing Practices.....	17

FIGURES

Figure 1. Basic Distribution Channels	4
Figure 2. Material Logistics Costs	6
Figure 3. Printed Matter Distribution Logistics Costs	8
Figure 4. Cash Flow Analysis	12

TABLES

Table 1. Automation Example Cash Flows (\$000).....	11
Table 2. Example Performance Goals.....	15

Preface

Virtually every government organization buys and consumes material to support its operations. This report addresses what government executives need to know about the logistics of distributing those materials within an organization. The topics presented result from recent research the Logistics Management Institute (LMI) has done for various public-sector organizations. We address four specific subjects: when to stock items in an internally managed facility, how to determine the true cost of distribution, using automation in a logistics operation, and improvements common to many organizations we have studied.

Material Distribution Logistics in the Public Sector

An Executive's Guide

INTRODUCTION

Most offices are equipped with furniture, computers, telephones, and various supplies, such as pens and paper. Organizations generally use some kind of special materials to provide public services: hospitals use medical supplies; mail sorting centers use material handling equipment and automated sorting machinery; laboratories use special test equipment and supplies; blood collection centers use specially produced labels; and so on. How does an organization get the material in the office or the special supplies the employees require? What does it cost to get those materials from a vendor to the point of use within the organization when needed?

Material distribution logistics is the process of getting products from manufacturers to consumers. Also known as supply chain management (and by other names) in the private sector, material distribution logistics is receiving the attention of companies such as General Motors Saturn Division, Compaq Computer, Wal-Mart, Sears, and many others. But what does it have to do with the public sector, where *services*, not *goods*, are being provided to the general population by governments and not-for-profit organizations?

In providing public services, organizations must consume resources. Those resources are not confined to the weapons systems procured by DoD. They include such materials as office supplies, forms, medical items, pharmaceuticals, food, furniture, computer equipment, communications devices, generators, motor vehicles, vending machines, automated sorting equipment, and repair parts of all kinds.

Material distribution logistics is important because it is expensive. Consider the following examples:

- ◆ In FY93, the United States Postal Service spent \$845 million acquiring supplies, equipment, and repair parts to support its vast distribution network of sorting centers, post offices, and repair facilities. It spent an additional \$579 million annually to get those materials to the point of use within that network.
- ◆ In FY92, the Department of Veterans Affairs spent about \$1.3 billion on medical, pharmaceutical, and food items to support its 171 medical centers across the country. It spent an additional \$111 million moving almost half of that material through a network of national and local warehouses; the

other half was provided directly to the medical centers from vendors at virtually no additional cost.

Material distribution logistics is clearly a major expense within the federal government and other public-sector concerns. Virtually every government agency consumes some type of material in doing its job. In 1993, federal, state, and local governments combined spent \$194 billion on goods. We estimate that the cost of delivering those goods to their points of use, through both public- and private-sector channels, ranges anywhere from 1 percent of the value of the goods to 150 percent, depending on the items in question. A large savings can be realized by reducing those distribution costs. In fact, if annual logistics costs are just 20 percent of the material value procured, a conservative estimate, then our governments are spending \$776 annually per person in this country to move and store materials in support of their programs.

This paper is divided into four parts that address what government executives need to know to ensure that their organizations can provide employees, as efficiently as possible, the material they need to do their jobs. The topics presented result from recent research we have conducted for various public-sector organizations. Our four-part paper includes the following sections:

- ◆ *When to Stock.* We address the rationale for determining when and when not to stock items in an internally managed distribution network.
- ◆ *The Cost of Internal Distribution.* We discuss how to determine the cost of internal distribution to the organization for specific products.
- ◆ *The Use of Automation.* We present some issues that need to be considered when contemplating the use of automation to improve the business.
- ◆ *Common Improvements.* We provide some common improvement ideas and principles applicable to the distribution environment.

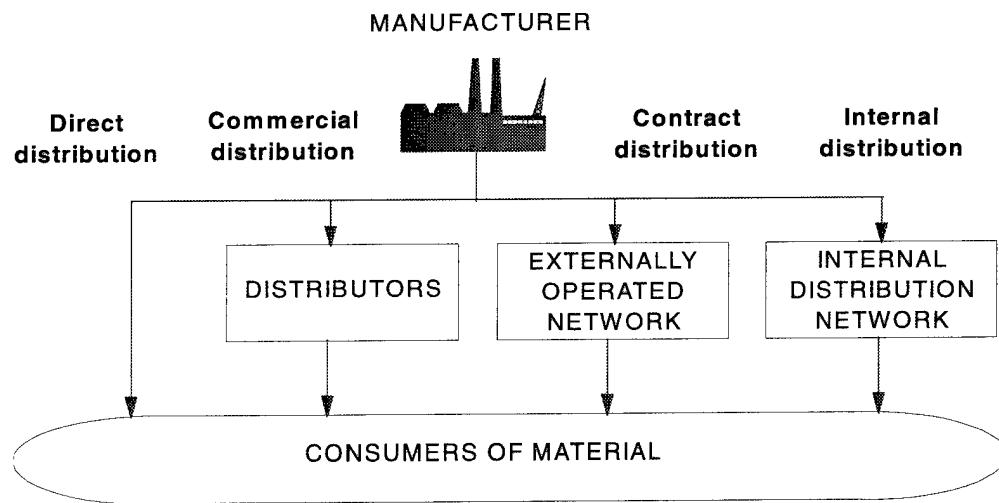
The paper is geared toward government organizations, although many of the ideas presented are currently in use in some form within the private sector.

PART I—WHEN TO STOCK

There were many very valid reasons 20 or more years ago to stock items in an internally run warehouse or distribution center and then ship them to consumers as their needs for those items arose. First, stocks were warehoused to take advantage of substantial quantity discounts. Items could be procured from vendors at much lower unit costs when bought in bulk because the manufacturers could produce large lots much more economically. Second, the process of ordering was expensive, so it made sense to trade off the cost of placing orders against the costs of stocking inventory. This tradeoff is basically recognized in the economic order quantity formulas common to many businesses. Third, service times from vendors were slow in comparison to consumer needs, so warehouses stocked with supplies were placed close to the consumers of those supplies. A needed item could then be obtained quickly if it was in stock at a nearby supply center or depot. Finally, some items were specially made for government use, particularly in DoD, and took a long time to procure. Relatively quick consumer delivery requirements dictated that these long-lead-time items be stocked somewhere to satisfy needs. The government today is full of many examples of depots, warehouses, and service centers that stock items for these and other reasons.

The principal question that many firms are asking today is not “How much should we stock in our warehouse?” but rather “What distribution channel should we use to provide material to consumers?” Figure 1 portrays the four basic types of distribution channels available. We can operate our own warehouse or network of warehouses (right-most channel in Figure 1). That network can be single-level, with just one warehouse between the supplier and consumer, or it can be multi-level, with perhaps a wholesale level and then a retail level warehouse between the supplier and the consumer. We can outsource the warehousing and distribution business to others (second channel from right). This can be accomplished by hiring contract logistics providers that run facilities dedicated only to our business, or we can hire providers with facilities and networks that service many organizations at once.

Figure 1. Basic Distribution Channels



We can use a commercial distributor to obtain our needed items (second channel from left). For many items, there are well developed commercial private-sector distribution networks. Some examples of items that can easily and cost-effectively be obtained in this manner include medical supplies, office supplies, computer equipment, and mechanical hardware. (There are many other examples.) Finally, we can provide items to consumers that are shipped directly from the manufacturer when needed (left-most channel, labeled "Direct Distribution"). Manufacturers are producing and shipping smaller quantities more frequently, and those smaller quantities are going to consumers rather than warehouses or distributors. This channel is particularly appropriate when consumers can wait days or weeks for a particular product. Office furniture is a good example.

Many of the reasons for stocking items in the past are no longer valid. Quantity discounts can be obtained through contractual means rather than physically taking ownership of a product. Manufacturers today are continually reducing setup costs and manufacturing lot sizes, the result being that small quantities can be economically and rapidly produced. Ordering processes today are being automated and contracts are being negotiated with one or a few vendors to provide many items, so that when material is needed there are no complicated procurement rules to follow in obtaining it. Service times from vendors of all types are quick, the cost of 24-hour service is not high, and many items can be routinely provided in one or a few days at no extra cost. Recognizing its high cost, the government is using less specially made material. All of these changes eliminate reasons to stock material.

In today's environment, the principal reason for stocking items in warehouses is not cost related but lead-time related. If the item can be received by the consumer within an acceptable time frame without being stocked, then it does not need to be stocked. Generally speaking, this costs no more, when total costs are taken into

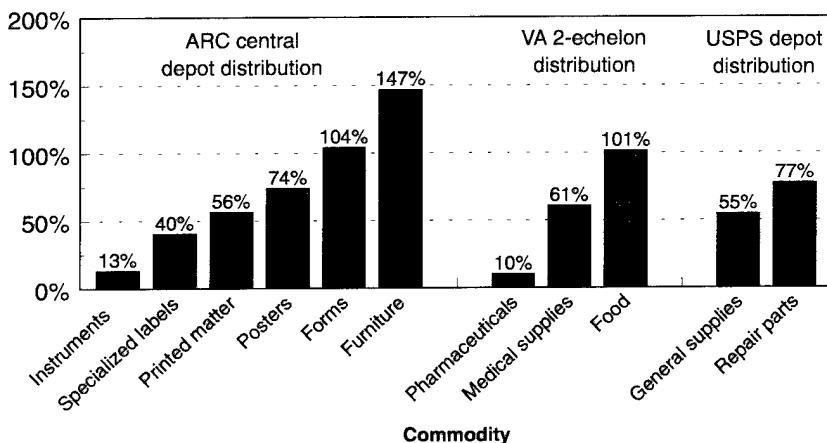
account, than it would if it were stocked, and in many cases it is more cost-effective. In several instances, there is no extra charge at all. Today, the primary reason to stock an item is if it cannot be obtained from a vendor (a manufacturer or distributor) within an acceptable time frame to the consumer. This includes special one-of-a-kind buys and contingency material purchases, for which long lead-times dictate stockage.

High level decision-makers must take part in the stocking decision. When the decision is left to warehouse or item managers, they will often decide to stock items. There is little motivation for them to seek out alternative forms of distribution, which they see as a threat to their jobs. Realistically speaking, those alternative forms could result in some job loss, but they usually result in a change of job definition. The dynamics of making stocking decisions must be changed so that cost-effective choices are made. This change requires the involvement of executive management to be effective, and it may require a fundamental shift for many organizations to charging consumers for the cost of their services in order to more accurately capture the true cost of item stockage.

PART II—THE COST OF INTERNAL DISTRIBUTION

The cost of getting needed material to consumers can be considerably more than just the purchase price. We refer to this cost as logistics cost or distribution cost. It represents the total cost, over and above the purchase price of the material, of getting that material from a supplier to a user. We express it as a percentage of the value of the material to properly illustrate its magnitude. Figure 2 shows some examples of logistics costs of different material commodities for three public organizations with internal distribution networks. These costs range from 10 percent of the material value to an enormous 147 percent. Some of the variation is due to the unique characteristics of the material in question, some to the way in which it is distributed, and some to the overall value of the material itself (since we are expressing cost as a percentage of that value).

Figure 2. Material Logistics Costs



Source: LMI studies RC301, VA201, PS401.

Note: ARC = American Red Cross, VA = Department of Veterans Affairs, USPS = United States Postal Service.

The term “value-added” distribution cost is now used in the medical world to describe the cost of distributing pharmaceutical and medical supplies. Typically, a prime vendor of pharmacy items charges its customers (organizations with pharmacies) anywhere from 0 to 2 percent of material value. Similarly, prime medical supply vendors charge their customers anywhere from 4 to 6 percent above purchase price. Interestingly enough, because these distributors are not part of the organizations they typically serve, their costs (or prices to their customers) are well defined. But when items are distributed internally, the true cost of doing so is often masked. Budgets are spread over many different types of items; often, different parts of the organization pay different portions of the cost.

There are many different cost components that make up the total cost of distribution. Direct costs include labor, transportation, facility-related expenses, equipment expenses, supplies, capital (quantified by debt costs or opportunity interest

rates), and risk (quantified by the expected percentage of purchases that are eventually written off the books). Indirect costs include management, customer service, purchasing, and systems support. It is fairly easy for most organizations to gather these and other costs in the aggregate, but the task of splitting them out among various product lines or commodities is more complicated.

We have used an approach to splitting these costs that essentially treats each cost element differently, basically an activity-based costing method. The steps we advocate are as follows:

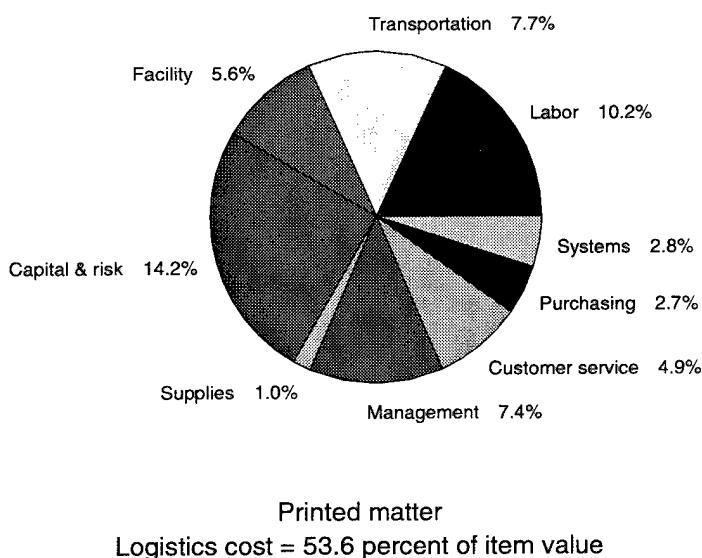
1. Classify like items in some convenient way. We have used general commodity descriptions, such as drugs or food, and have also successfully used specific Interstate Commerce Commission freight classifications, such as printed matter or rolled posters.
2. Gather specific cost or workload information by item class:¹
 - Pick lines
 - Receipt lines
 - Weight shipped
 - Cube shipped
 - Dollars shipped
 - Dollars of inventory
 - Number of item records managed in the automated system.
3. Allocate each cost component using the most appropriate data:
 - Labor—pick lines
 - Transportation—weight or cube
 - Facility expenses—cube
 - Capital and risk—dollar investment in inventory
 - Supplies—cube
 - Management—number of item records

¹ Some of this information may not be available by item (e.g., weight, cube, or receipt lines). These values can, however, be approximated through sampling or, in some cases, reviewing shipping records. Cube information can be obtained by relating cubic feet of storage space for types of items to the dollar value they represent and then converting dollars to cubic feet when necessary.

- Customer service—number of item records
- Purchasing—number of line items received
- System support—number of item records.

Figure 3 portrays a real example of the logistics costs associated with distributing printed matter at the American Red Cross. Our approach renders an accurate picture of these costs, and the method can be applied to in-house (or any other form of) distribution. (Direct costs associated with externally run distribution channels are usually well defined, but our method can be used to identify the indirect costs for items distributed in those channels.) When it is used for comparison with direct distribution from a manufacturer, the direct distribution costs should identify some portion of product price that represents the added cost of obtaining items directly from that manufacturer.

Figure 3. Printed Matter Distribution Logistics Costs



There are three important cost tradeoffs in distribution logistics. The first is *transportation versus inventory*. Infrequent deliveries or receipts allow goods to be consolidated and shipped at lower rates but require the buildup of inventories at warehouses or consumer locations. Also, lower transportation costs can sometimes be achieved by having multiple levels of inventory in the distribution system. Generally speaking, the higher the inventory, the lower the transportation expense, and vice versa.

The second cost tradeoff is *purchasing versus inventory investment*. Infrequent purchases can lead to lower purchasing costs but higher inventories and correspondingly higher storage, capital, and risk costs. Companies that successfully

reduce their purchasing costs through a combination of long-term vendor contracts and automation can enjoy the benefits of much lower storage, capital, and risk costs because they give themselves the ability to order more frequently without incurring additional administrative cost.

The third cost tradeoff is *automation investment versus labor*. Investment in systems and equipment automation can lead to higher productivity in receipt, storage, and issue operations as well as procurement and customer service. Not all automation results in higher productivity (see Part III), and organizations must carefully plan their automation projects to ensure that benefits are achieved. From a purely financial standpoint, the greater the automation, the more fixed costs an organization possesses. That, in turn, may become a problem if the volume of material handled by the automated equipment or systems decreases over time, because those fixed costs must now be spread over a smaller base of items.

Why is identifying true costs important? It allows both consumers and providers of distribution services to see what items are costly to store and distribute. It can be used to help determine the best distribution channel for a particular set of products, and it can be used to benchmark against others in an effort to make internal improvements.

PART III: THE USE OF AUTOMATION

Consider the example of a potential automation investment for a warehouse employing 30 individuals. The warehouse manager is asking for approval of a \$1 million investment in automated storage equipment that will eliminate the need for employees to walk to warehouse locations to store and retrieve items. The money is available in the budget. Should the investment be approved? This example is typical of ones we see every day.

Consider the government accounting environment. Investments are often expensed. The funds to make those investments often come from the annual operating budget. Furthermore, in many cases, investments are justified simply on the basis of funds availability and little else. To make matters worse, there are no standard government accounting practices that dictate how assets should be handled financially. The only motive that government managers have to make sound investment decisions is public accountability. If they make a poor choice, they have not made prudent use of taxpayer dollars.

But just what is a sound investment? The savings from the investment over some period of time should be greater than the costs. This means we must ensure that all savings are quantified, including the cost of making no investment. For example, if we must invest in a new computer system to keep our customers (or consumers of material) from going elsewhere and paying more money, then the cost of not automating is the additional amount our material consumers will pay others to provide logistics services if we do not install the computer system. Just as in the private sector, the concepts of return on investment, net present value, and discounted payback period are applicable.

What are some typical benefits? The most common benefit is the labor savings associated with handling material (receiving, picking, moving, counting, etc.). Other benefits include lower inventory investment (resulting in lower capital costs and less write-off), elimination of maintenance costs of equipment no longer used, lower storage costs due to reduction of space needs, and the ability to reduce order turnaround times and therefore save consumers from storing items at their point of use. All of these can and should be quantified when making the decision to invest.

What are some typical costs? The biggest is usually the initial cost of the investment, but there are other hidden costs. They include the cost of installing equipment and getting it running, the cost of maintaining equipment and systems over time, and the cost of specialty labor needed to operate the equipment if that labor is different from the current work force. All of these and any other known costs should be included in the equation.

In regard to the warehouse example, after doing some investigating we have found that the investment will save three full-time equivalents at a cost of \$40,000 each annually. Corresponding systems improvements will cost \$100,000 but will reduce required inventory by \$500,000. The cost of capital is 12 percent per year, and approximately 3 percent of inventory is written off each year. Maintenance costs are estimated at \$50,000 per year. We can reduce our storage space requirements by 10,000 square feet with the new equipment. That space costs us \$10 a square foot and can be returned to the landlord and rented to another tenant. We will, however, need a computer systems operator at a cost of \$50,000 per year. Finally, some of the items currently stocked will eventually be provided directly from vendors, resulting in a gradual decline in the need for warehouse space. We show a summary of these cost and benefit cash flows in Table 1. The net investment is \$1.1 million, and net annual savings are \$635,000 in the first year and \$135,000 thereafter. We do not include any inflationary effects in the example.

Table 1. Automation Example Cash Flows (\$000)

Cost/savings	Year 0	Year 1	Year 2	Year 3	Year 4	Years 5+
Initial investment	-1,000					
Labor savings		120	120	120	120	120
Systems improvements	-100					
Inventory savings		500				
Inventory write-off savings		15	15	15	15	15
Maintenance costs		-50	-50	-50	-50	-50
Storage space savings		100	100	100	100	100
Systems operator		-50	-50	-50	-50	-50

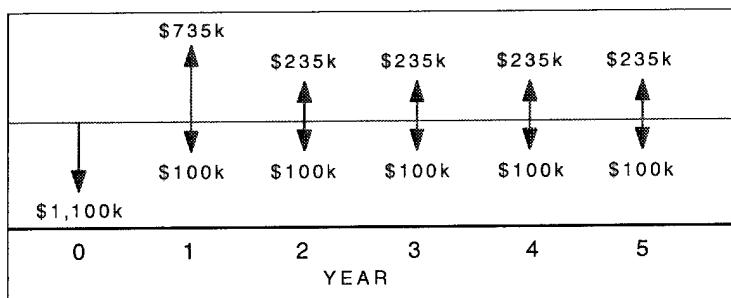
Note: Figures assume 0 percent inflation.

Knowing this, should we make the investment? Figure 4 is a pictorial representation of the resulting cash flow analysis. Based on the numbers alone, the investment is risky because it would take over 7 years to pay back and its internal rate of return is only 3.2 percent. Over a 5-year time horizon, the net present value is negative. Given the added risk that much less space will be needed in the future because of changing distribution channels, it is unlikely that it would be considered.

There are some important lessons to understand about equipment automation:

- ◆ *Machines have capacity constraints and people do not.* Machine capacities should be understood before purchase, not afterwards. Assigning more people to finish a task will complete it more quickly, but machinery restricts that capability.

Figure 4. Cash Flow Analysis



Net Present Value: \$ (167) k
 Internal Rate of Return: 3.2%
 Discounted Payback Period: 7.7 years

- ◆ *Machines can constrain service times.* Overall capacity may be sufficient, but that capacity might be spread over two shifts instead of one.
- ◆ *Machines break down.* Having good preventive maintenance and repair contingency plans in place will solve many problems.
- ◆ *How machinery will actually affect labor productivity must be understood.* We have seen too many cases in which automation did not actually result in any less labor needed to do the job. Will the automation reduce travel time? If so, how much of a person's time is spent traveling between locations in the warehouse? Are there other ways to reduce that time without adding an expensive piece of equipment?
- ◆ *Comprehensive planning facilitates the transition.* No transition is perfect, but many problems can be avoided by imagining them in advance and then trying to prevent them from happening.
- ◆ *Follow-through and change probably will be necessary during the implementation process.* It is important to have someone in charge that can resolve problems fully and stay with the project until it operates smoothly.

Understanding these lessons ahead of time will enhance the success of any equipment automation project.

There are also some important lessons to understand with systems automation.

- ◆ *Developing an in-house system is expensive and time-consuming.* In the warehousing/distribution business there is a plethora of already-developed software that can handle most requirements. In-house development will probably result in the completion of a system that is obsolete by the time it is ready to be used.
- ◆ *Once installed, a system must be supported.* If there is no systems support staff, one will be needed when a system is added.
- ◆ *Users should be involved from the start in specifying systems requirements.* Ultimately, it is their productivity that the system affects, and they have good insight on how they can benefit from it.
- ◆ *As with equipment, up-front planning is the key to a smooth transition from an old system to a new one.*

Following these lessons will improve your chances of success in installing or replacing an automated system in your distribution business.

PART IV—COMMON IMPROVEMENTS

In the first three parts of this report, we addressed when and what to stock internally, the determination of distribution costs, and the use of automation. Having outlined a distribution strategy, we now focus on some more tactical improvements. We offer eight areas of opportunity common to many government organizations.

Outsource

Some organizations have taken to outsourcing, or contracting, as a way to cut costs and improve service. Outsourcing provides two distinct benefits: the ability to treat all costs as known and variable, and the ability to draw on the knowledge and customer base of logistics experts to carry out the distribution function.

The first advantage, known and variable costs, is important if current costs are unknown and not communicated to consumers. It also helps avoid making heavy investments now with a payback coming over a long time horizon (the purchase of a building or equipment, for example). Outsourcing may help in managing costs as variable ones.

The second advantage, the use of logistics experts, can cut costs and improve service for some organizations. If an organization is already running efficiently, then using a contractor may not be an improvement. Most organizations, however, are not expert at providing distribution services. The benefit that a contractor can provide is access to the latest systems and knowledge of the most cost- and service-effective ways to get the job done. Even though contract providers are in business to make a profit for their shareholders, they may be able to provide their services more efficiently than you can provide them to yourself because of their knowledge of the business. Also, they may experience lower costs due to economies of scale created by serving multiple organizations with one pool of resources. The decision to outsource should take both the cost of and services provided by the contractor into account.

Broaden the Scope of the Logistics Team

The scenario is all too common. The logistics staff is responsible for warehousing and shipping the product to consumers. Adopting alternative distribution channels puts them out of work. The only job they are tasked with is ensuring that the product is stored, picked, and shipped in a timely manner.

That same logistics staff could be put in charge of getting products to consumers. They would be free to get it to those customers in the most cost-effective way, even if it means closing a warehouse or using a third party to do it. At the very least, someone in the organization has to have a broad logistics responsibility that

is not strictly confined to an ineffective, obsolete warehouse or depot storage system.

Focus Consumers on Total Cost

The typical government organization focuses on the cost of materials and not on the cost of providing them. If both the cost of materials and the cost of distributing those materials is understood and recognized, then consumers can be charged for both of those costs when the material is provided. Many organizations are moving toward this fee-for-service approach to providing logistics services. It is not enough to simply allocate a fixed percentage (that, in total, equals your budget) to all items provided. The allocations should be different for different types of products, depending on the amount of storage, handling, and other resources they consume relative to the total. The consumer focuses on those markups or allocations, and the supplier focuses on finding the least expensive way to provide each type of item.

Add Customer Performance Reporting

The supplier needs to be able to tell customers (consumers of material) how well or how poorly they are being served so they understand what they are getting. The organization should adopt performance measures for cost, service, and quality. Cost can be measured in terms of cost per unit shipped or received or cost as a percentage of value (by product type, as advocated previously, if possible). Service times should be measured as the total cycle time from placement of an order to receipt of goods by the consumer. One common way to track it is to measure the percentage that falls within some predefined goal, e.g., 98 percent received within 72 hours. Table 2 shows sample service time, denial rate, and location accuracy goals.

Table 2. Example Performance Goals

Priority/category	Performance goal
Emergency issues	99% processed within 1 day
Normal issues	95% processed within 8 days
Receipts (new items)	99% processed within 4 days
Denial rate	0.8 denials per 100 lines
Location accuracy	99% accurate

Source: Defense Logistics Agency.

Often, organizations simply measure the time it takes from order placement to the time something is shipped because there is not always a way to find out when a consumer received an order. Quality should be reflected as some measure of consumer satisfaction with the service provided.

Communicate Frequently with Customers

Many organizations lose sight of who their customers are—although the customers (consumers of material) are the reason for their existence. They should be continually listened to and their needs identified. If the customer is not being satisfied, the supplier needs to know and make changes. One organization (with which we recently worked) makes its customers, in effect, stockholders in its logistics operation. Those customers actually decide how valuable warehouse space is best used and allocate that space among themselves. As “stockholders” they are getting feedback on warehouse performance for the first time, and they are motivated to ensure that cost-effective buying decisions are made because the amount of space available to them is limited.

Try Operating Logistics as an Independent Business

Operating a logistics service as a separate business from the organization served reveals strengths and weaknesses. This type of operation may include

- ◆ Making service guarantees to customers (material consumers) and paying for the costs of not meeting those guarantees out of your own budget;
- ◆ Testing your competitiveness against outside logistics services; and
- ◆ Charging customers for services provided, but allowing them to obtain those services from other providers.

These changes will expose opportunities for improvement and may result in some loss of customers. They will certainly motivate employees to work more efficiently and could, in the long run, result in greater consumer satisfaction

Streamline the Excess Property Handling Procedures

Long periods of time and large quantities of money are spent storing material that, in many cases, is going to be discarded. Time and space are valuable. Those responsible for excess property should do everything possible to reduce the amount of time spent handling these items and the time they sit idle in a facility. One organization with which we dealt is turning much of this over to the General Services Administration. Another is allowing its consumers greater leeway in disposing of material with little or no value. While some of it is valuable and can be reused, there is much material moving through government distribution systems that costs more to store and handle than to buy. While government property disposal regulations must be satisfied, the goal should be to minimize storage and handling costs while allowing the organization to reutilize as much material as possible.

Follow Basic Warehousing Practices

Good warehouse practices should always be followed. Here is a list of some very basic approaches we have recommended to others:

- ◆ *Focus on areas with the greatest workload.* If 50 people are dedicated to packing and shipping operations and only 2 dedicated to storage and issue, then automating the pick process will not result in much savings; the opposite is true for the packing or shipping process.
- ◆ *Streamline the order picking process.* If there is an opportunity, many novel ways can be used to simplify order picking. Traditional order picking involves spending lots of time traveling (walking or driving) around a warehouse to find all of the items needed to fill an order. Order batching and use of more efficient types of material movement equipment can greatly reduce or eliminate that travel time.
- ◆ *Perform location checks.* More often than not, when physical balances do not agree with computer system balances, it is because products are mislocated. Actual storage locations differ from those recorded in the automated system. By simply auditing locations and checking to make sure they are recorded in the database, without regard to the quantities in those locations, an organization can improve its system accuracy and overall productivity in filling orders. Location auditing is extremely cost-effective because it takes little effort (much less than for cycle counting or invento-
rying) and yields high dividends.
- ◆ *Use new storage technologies.* There are numerous storage technologies that help reduce the previously mentioned warehouse travel time. Generally, these technologies bring the material to the warehouse employee. The most cost-effective type (in terms of cost per cubic foot of storage space) is a horizontal carousel. Other technologies used include vertical carousels, vertical columns, mini-loads, and full blown automated storage and retrieval systems.
- ◆ *Adopt internal performance measures.* It is difficult for an organization to improve if it does not know how well it is doing. Management and employees must have this information so they will be motivated to improve their performance. Some common performance measures include:
 - ▶ cost per pound (shipped),
 - ▶ receipt to stow time (or percent receipts on time),
 - ▶ normal order-to-ship time (or percent normal issues on time),

-
- emergency order-to-ship time (or percent emergency issues on time),
 - fill rate,
 - inventory record accuracy,
 - location record accuracy,
 - denial rate,
 - discrepancy rate, and
 - productivity in functional areas (lines per hour).

All of these internal performance measures should in some way be components of those measured and reported to consumers (cost, service, and quality). These and other performance measures are necessary to the success of any logistics operation and, simply by measuring them, an organization can improve through awareness and focus.

These approaches are just a few of many that organizations today are taking. While there is much money being spent on automating systems and equipment, success can be found in changing and streamlining procedures. Indeed, in an environment that changes from year to year, these approaches can be much more cost-effective than ones involving high dollar investments with a payback coming over very long periods of time.

The Logistics Management Institute is a Federally Funded Research and Development Center. It is committed to providing the public sector with advice—free of commercial or political interest—across a broad spectrum of logistics, acquisition, and administration issues.

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